UNIVERSITI TEKNOLOGI MARA

ANALYSIS OF HEAT DISTRIBUTION IN FRICTION STIR WELDING USING FINITE ELEMENT METHOD

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of the requirements for the degree of
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Faculty of Mechanical Engineering

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 25th March 2016 to conduct the final examination of Mohammad Shamil Bin Jaffarullah on his Master of Science thesis entitled "Analysis of Heat Distribution in Friction Stir Welding Using Finite Element Method" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

Three-dimensional model for simulated process is carried out by using Altair HyperWorks, a commercially software was used to obtain temperature distribution in Friction Stir Welding (FSW) of Aluminium Alloy 6061. In order to achieve temperature distribution in the welded aluminium plates during welding operation, heat input from tool shoulder and tool pin were considered in the model. Heat generation characteristics are critical to good quality welds obtained in the important engineering by the Friction Stir Welding (FSW) process. As part of the effort to understand these characteristics, butt joint welding was studied and its thermal profiles were obtained both numerically and experimentally. The temperature distribution in the workpiece during FSW process is experimentally measured from the device thermal imaging camera at exact location on the workpiece in the welding direction. The developed model was then used to show the effect of various input parameters. For this purpose, five levels for each parameter (rotational speed and traverse speed) have been selected. The temperature history predicted from simulated model is compared with that of experimental values and is found to be in good agreement validating the numerical model. Parametric study to determine the effects of tool rotational and traverse speed on the performance of weld is carried out by predicting peak temperatures. Finally, it is shown that at constant tool rotational speed, it is observed that peak temperature during welding decrease when the tool traverse speed increase. When the rotating speed is increased, the heat input is also increased, which leads to higher temperature.

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